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A20T17 A20T18

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US 5196092 A JP 020178023 A  
US 4492063 A US 4944087 A  
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(58) Field of Search:  
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INT CL<sup>7</sup> B29C, B29D, B32B, E06B  
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(54) Abstract Title: Surface preparation

(57) The invention comprises a method of forming a component 1 with a surface 3 suitable for adhesion, the method comprising embedding a relatively flexible material 2 in a plastics material and forming the component 1 from the plastics material, whereby the relatively flexible material 2 is embedded in and covers a surface of the so-formed component 1 in a region where it is intended to adhere to a further object. The component may be a frame member 1 or a skin member 6 for the formation of a door. The frame member 1 may be pultruded and the relatively flexible material may be an open weave fabric 2. The material 2 is removed from members 1 and 6 to reveal a clean, abraded surface 3,4 which is suitable to adhere members 1 and 6 together to form the door. Methods of forming a door have also been claimed.

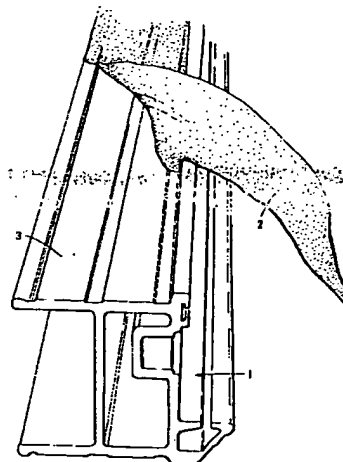


FIG. 1B

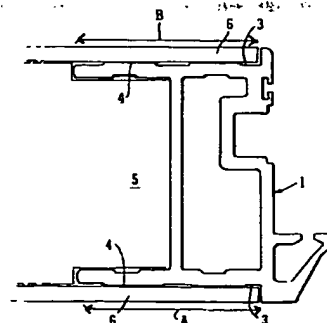


FIG. 2

GB 2 393 932 A

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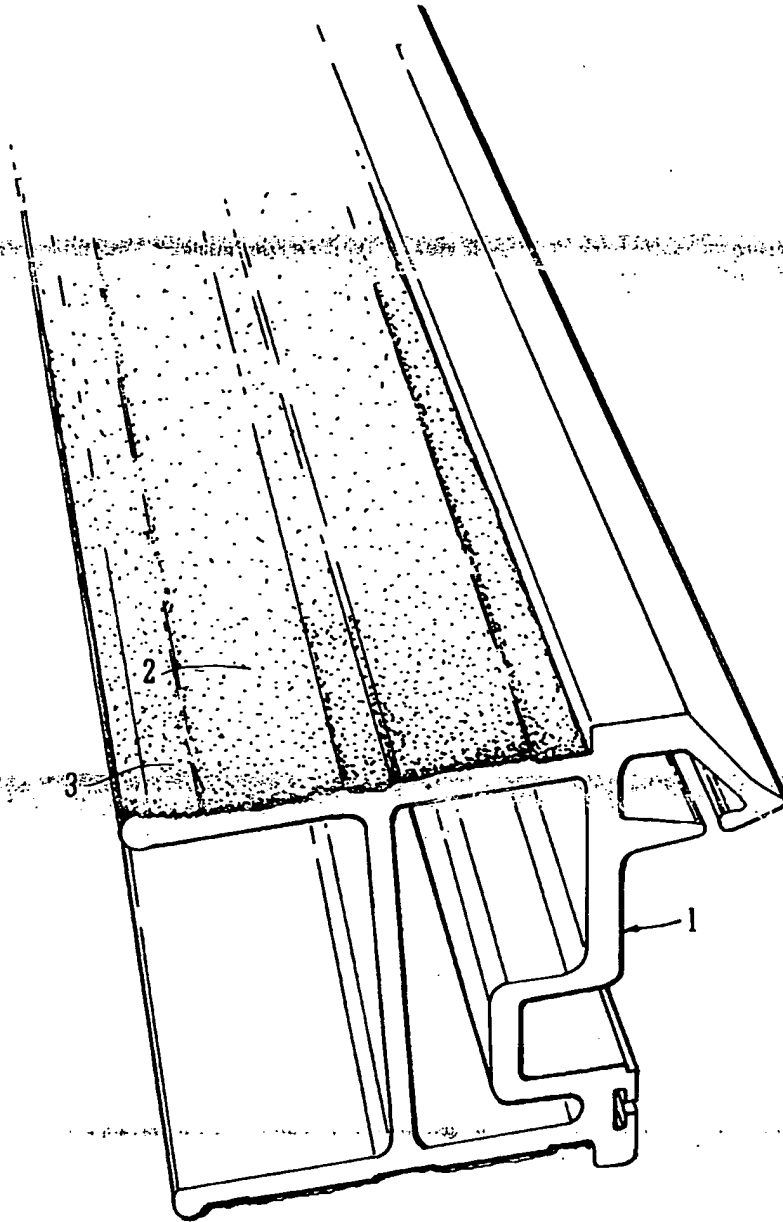


FIG. 1A

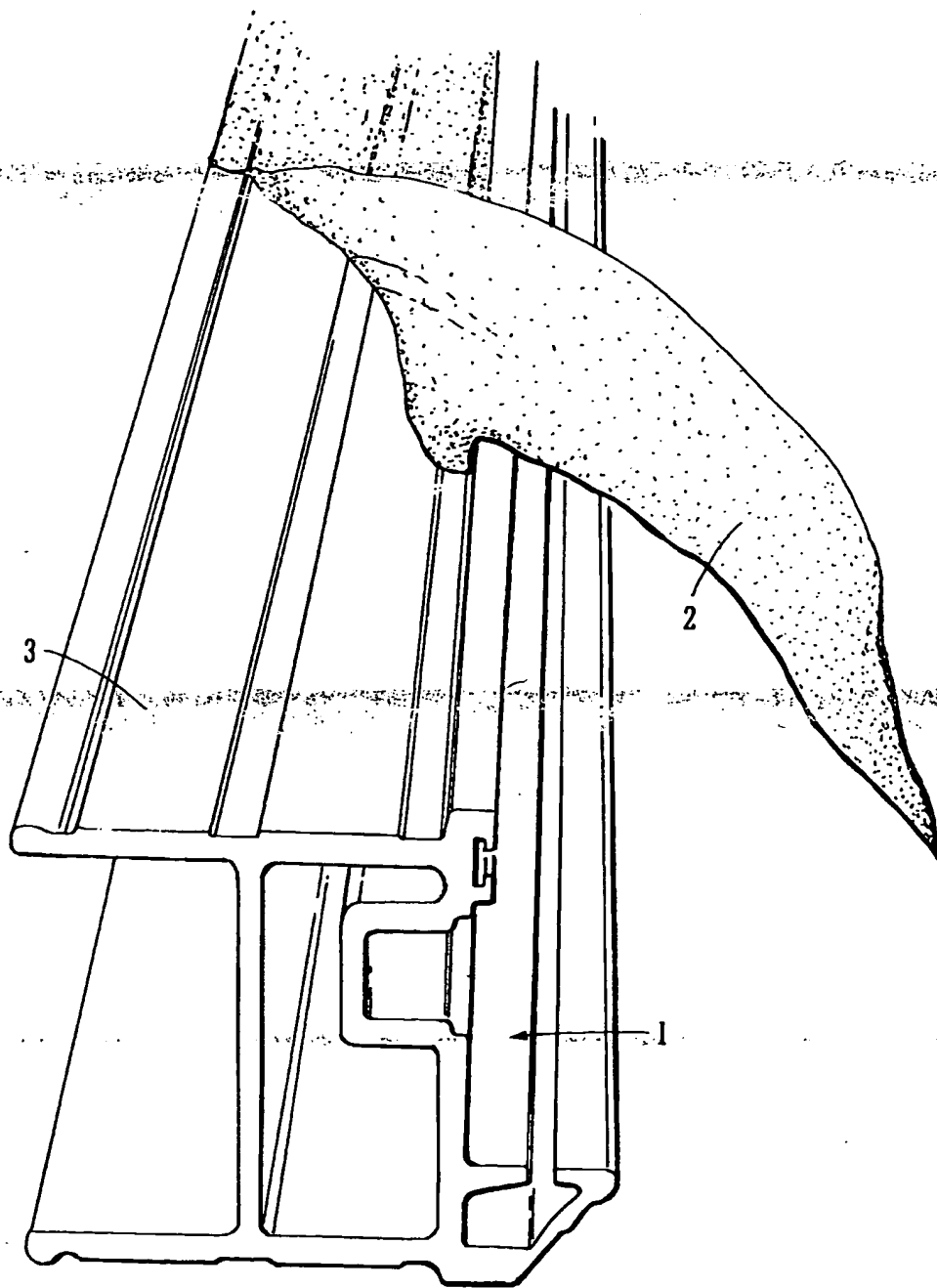


FIG. 1B

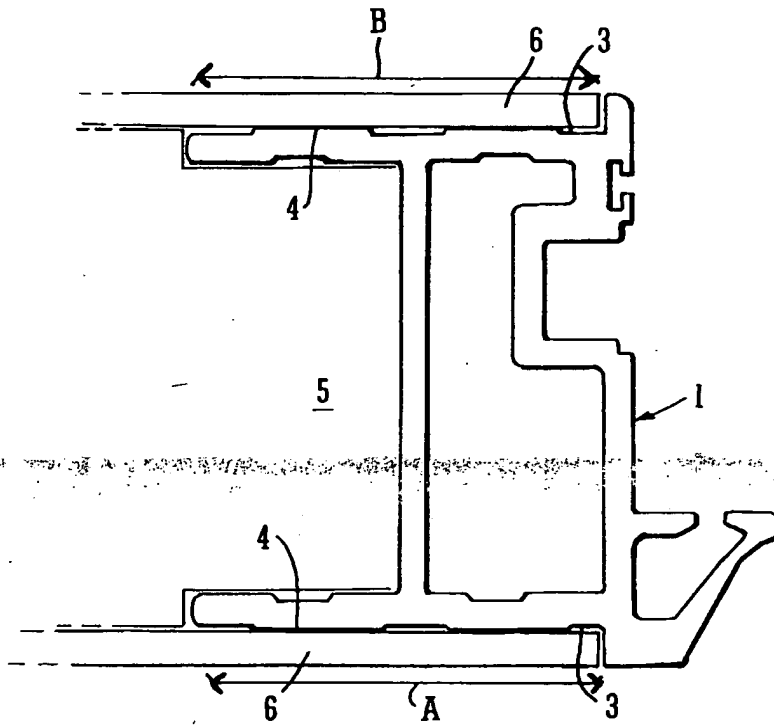
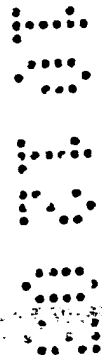


FIG. 2



## Surface Preparation

5           This invention relates to the preparation of a surface of a component of, say, a door.

          It is known that components formed by processes such as moulding, extrusion or pultrusion may be used for a variety of purposes. Such processes are common in  
10 industries which use plastics materials. One such industry is the manufacture of doors for external and internal use.

          Various patents have been published which propose the use of plastics materials to fabricate doors. In some such patents, plastics materials are used to  
15 manufacture a frame or chassis, a foam core and a panel which covers each major surface of the door.

          In our co-pending patent application no. 0200498.4 (published as GB-A-2371075) we describe and claim, *inter alia*, a method of forming a door comprising  
20 pultruding a synthetic material having a low coefficient of thermal expansion to form lengths, assembling the lengths to form a framework, and attaching panels to opposed faces of the so-assembled framework.

          Pultrusion is a process by which continuous elongate fibres e.g. one of glass,  
25 carbon or aramid, Terylene, Nylon or hemp are impregnated into a thermoset resin and pulled through a preformer into a heated die. The shape of the end product is determined by the die, the heat causing the resin to polymerise, e.g. cross link. By

using pultrusion, one can obtain lengths which can be cut to size and then joined together to form a frame. The lengths have a good strength/weight ratio. In the context of doors, it is useful to pultrude thermoset material to form the frame because the so-formed frame will consequently have a low coefficient of thermal expansion. If  
5 the panels are made from the same material, or of a material having the same property, one can have a door fabricated from components having a substantially uniform coefficient of thermal expansion.

A problem sometimes occurs in moulding, extruding and pultruding operations  
10 wherein a surface of a component, to which it is desired to adhere an object, is unsuitable for adhesion. The surface will either be too uneven to provide substantial contact between the surface and the object to be adhered or too smooth to key the adhesive. Preparation of such surfaces subsequent to formation of the component is costly and time-consuming.

15

Accordingly, it is an object of this invention to provide a method to ensure that a surface of a component, to which an object is to be adhered, is suitable for such adhesion.

20 A first aspect of the invention provides a method of forming a component with a surface suitable for adhesion, the method comprising embedding a relatively flexible material in a plastics material and forming the component from the plastics material, whereby the relatively flexible material is embedded in and covers a surface of the so-formed component in a region where it is intended to adhere a further object.

25

The forming step of the method may comprise co-pultruding the plastics material with the relatively flexible material or co-extruding the plastics material with the relatively flexible material.

- 5        As one alternative, the forming step of the method may comprise moulding, for example Resin Transfer Moulding (RTM) or the like.

The relatively flexible material is preferably an open weave fabric. The plastics material is preferably a thermoset plastics material and is preferably selected from one  
10 of GRP, vinyl ester, polyester, phenolic or epoxy resin.

The component may be an integer of a frame, for example a frame from which a door is to be constructed or the component may be a panel to provide the fascia of a door. Both panels and frame integers may be constructed using the method.

15

A second aspect of the invention provides a method of forming a door, the method comprising co-pultruding a plastics material with a relatively flexible material to form a frame member wherein the relatively flexible material is at least partially embedded within the surface of the frame member, cutting the frame member to length  
20 and joining a plurality of frame members together to form a frame, removing the relatively flexible material from the surface and adhering a panel to that surface.

A yet further aspect of the invention provides a method of forming a door, the method comprising moulding a plastics material to form a panel for a door with a  
25 relatively flexible material embedded within the surface of the panel along the edges thereof, removing the relatively flexible material from the surface and adhering the panel to a frame.

Preferably the open weave fabric is formed from glass fibres or from Terylene.  
In a preferred embodiment, the open weave fabric has from 3.9 – 11.8 threads per  
centimetre (10 to 30 threads per inch) in both the warp and weft, most preferably 7.8  
5 threads/cm (20 threads per inch) in both directions.

A further aspect of the invention provides a method of forming a door, the  
method comprising:

- forming frame members by pultruding plastics material;
  - 10 • forming a core and assembling frame members about edges of the core;
  - forming a plastics skin to be applied over the frame and core; and
  - joining the skin to at least the frame by an adhesive
- and characterised by including a detachable layer on a surface of each frame  
member or the skin or both to provide surface deformations to the underlying  
15 plastics surface, the detachable layer being removed prior to application of the  
adhesive; the deformations providing sites to key the adhesive whereby the  
strength of the bond formed exceeds that of the frame or the skin.

The invention also comprises a component for a door, and a door formed by the  
20 above-described methods.

In order that the invention may be more fully understood, it will now be  
explained by way of example only and with reference to the accompanying drawings, in  
which:

25

Figure 1A is a perspective view of a frame member formed by the invention;



Figure 1B is the frame member of Figure 1A after partial removal of a surface layer; and

Figure 2 is a transverse section through part of a door made in accordance with the invention.

5

Referring to the Figures, there is shown a profile 1 formed from pultruded thermoset plastics material. The profile 1 is co-pultruded with an open-weave fabric material 2 to cover a surface 3 of the profile 1, the fabric material 2 being fed into the pultrusion die with the plastics material.

10

Rovings of elongate fibres are advanced towards the die head and, just before entering the head, are sprayed or otherwise soaked in or with resin. The open-weave fabric material 2 is fed to the die head to enter with the resin soaked rovings. The rovings with the fabric material 2 emerge from the die head having been forced to adopt the desired shape. During passage through the head, the fabric material 2 is displaced towards the surface of the plastics resin by the rovings.

15

Consequently, the fabric material 2 is located just below the surface 3 of the profile 1 and is visible.

20

Lengths of profile 1 are cut to the appropriate size and adhered together to form a rectangular framework. The lengths of profile 1 may be assembled around a core material 5.

25

A skin 6 is formed from a thermoset material by RTM. An open-weave fabric material is placed within the mould prior to the RTM operation at the edges of the

mould. During RTM, the skin 6 is formed with the open weave fabric material being embedded therein at the edges of the skin 6.

Arrows A and B indicate the extent to which the open weave fabric 2 covers the surface of the profile 1 and the skin 6.

Prior to assembly of the profile 1 and skins 6 to form a door, the open weave fabric material 2 is removed from the assembled profiles 1 and skins 6 to reveal a clean, abraded surface 3, 4 which is suitable to adhere the components 1, 6 together. The surface 3, 4 is of exposed virgin material. Any loose material from the profile 1 and skin 6 is removed by rubbing or blowing air over the surface thereof. An adhesive, such as an acrylate or polyurethane, is spread over the areas to be adhered 3, 4 and the two components 1, 6 are brought together.

Because the material 2 is open weave, the plastics material is able to flow between the threads of the material 2 during the component forming process. This ensures that the surface of the profile and skin, subsequent to material 2 removal, is formed with a plurality of raised "islands". The height of these "islands" is typically 0.254 – 0.381 mm, although larger or smaller heights can be achieved by altering the thickness of the material. Therefore, the islands and associated recesses provided on the respective surfaces 3, 4 ensure that each surface 3, 4 is eminently suitable to key an adhesive.

It has been found in delamination and shear tests that the strength of the adhesive bond formed is so great in the inventive method that the profile 1 or skin 6 will fail before the adhesive bond.

It will further be appreciated that by forming a component with the fabric layer 2 adjacent a surface to be adhered to, that surface 3, 4 is kept both clean and dry.

Only one of the components (profile 1 and skin 6) need be formed with the  
5 fabric layer 2.

## Claims

1. A method of forming a component with a surface suitable for adhesion, the method comprising embedding a relatively flexible material in a plastics material and  
5 forming the component from the plastics material, whereby the relatively flexible material is embedded in and covers a surface of the so-formed component in a region where it is intended to adhere a further object.
2. A method according to Claim 1, wherein the forming step comprises co-pultruding  
10 the plastics material with the relatively flexible material.
3. A method according to Claim 1, wherein the forming step comprises co-extruding the plastics material with the relatively flexible material.
- 15 4. A method according to Claim 1, wherein the forming step comprises moulding, for example Resin Transfer Moulding (RTM) or the like.
5. A method of forming a door, the method comprising co-pultruding a plastics material with a relatively flexible material to form a frame member wherein the  
20 relatively flexible material is at least partially embedded within the surface of the frame member, cutting the frame member to length and joining a plurality of frame members together to form a frame, removing the relatively flexible material from the surface and adhering a panel to that surface.
- 25 6. A method of forming a door, the method comprising moulding a plastics material to form a panel for a door with a relatively flexible material embedded within the

surface of the panel along the edges thereof, removing the relatively flexible material from the surface and adhering the panel to a frame.

7. A method of forming a door, the method comprising:

- 5       • forming frame members by pultruding plastics material;
  - forming a core and assembling frame members about edges of the core;
  - forming a plastics skin to be applied over the frame and core; and
  - joining the skin to at least the frame by an adhesive
- 10       and characterised by including a detachable layer on a surface of each frame member or the skin or both to provide surface deformations to the underlying plastics surface, the detachable layer being removed prior to application of the adhesive, the deformations providing sites to key the adhesive whereby the strength of the bond formed exceeds that of the frame or the skin.

15   8. A door formed by the method of Claim 5 or Claim 6 or Claim 7.

9. A plastics component for a door having a relatively flexible material embedded in a surface thereof.

20   10. A component according to Claim 9, wherein the relatively flexible material is an open weave fabric.

11. A component according to Claim 10, wherein the open weave fabric is formed from glass fibres or from Terylene.

12. A component according to Claims 10 or 11, wherein the open weave fabric has from 3.9 – 11.8 threads per centimetre (10 to 30 threads per inch) in both the warp and weft, most preferably 7.8 threads/cm (20 threads per inch) in both directions.

5 13. A component according to Claim 10, 11 or 12 formed from a thermoset plastics material, preferably selected from one of GRP, vinyl ester, polyester, phenolic or epoxy resin.

14. A component according to any of Claims 9 to 13 in the form of a frame member.

10

15. A component according to any of Claims 9 to 13 in the form of a panel.

16. A method substantially as hereinbefore described.

15 17. A component substantially as hereinbefore described with reference to Figures 1A, 1B and 2.

11

**Amendments to the claims have been filed as follows**

1. A method of forming a component with a surface suitable for adhesion, the method comprising embedding a relatively flexible open weave fabric material in a plastics material and forming the component from the plastics material, whereby the relatively flexible material is embedded in and covers a surface of the so-formed component in a region where it is intended to adhere a further object.
2. A method according to Claim 1, wherein the forming step comprises co-pultruding the plastics material with the relatively flexible, open weave fabric material.
3. A method according to Claim 1, wherein the forming step comprises co-extruding the plastics material with the relatively flexible open weave fabric material.
4. A method according to Claim 1, wherein the forming step comprises moulding, for example Resin Transfer Moulding (RTM) or the like.
5. A method of forming a door, the method comprising co-pultruding a plastics material with a relatively flexible open weave fabric material to form a frame member wherein the relatively flexible open weave fabric material is at least partially embedded within the surface of the frame member, cutting the frame member to length and joining a plurality of frame members together to form a frame, removing the relatively flexible open weave fabric material from the surface and adhering a panel to that surface.

6. A method of forming a door, the method comprising moulding a plastics material to form a panel for a door with a relatively flexible open weave fabric material embedded within the surface of the panel along the edges thereof, removing the relatively flexible open weave fabric material from the surface and adhering the panel to a frame.

7. A method of forming a door, the method comprising:

- forming frame members by pultruding plastics material;
- forming a core and assembling frame members about edges of the core;
- forming a plastics skin to be applied over the frame and core; and
- joining the skin to at least the frame by an adhesive

and characterised by including a detachable open weave fabric layer on a surface of each frame member or the skin or both to provide surface deformations to the underlying plastics surface, the detachable open weave fabric layer being removed prior to application of the adhesive, the deformations providing sites to key the adhesive whereby the strength of the bond formed exceeds that of the frame or the skin.

8. A door formed by the method of Claim 5 or Claim 6 or Claim 7.

9. A plastics component for a door having a relatively flexible open weave fabric material embedded in a surface thereof.

10. A component according to Claim 9, wherein the open weave fabric is formed from glass fibres or from Terylene.



11. A component according to Claims 9 or 10, wherein the open weave fabric has from 3.9 – 11.8 threads per centimetre (10 to 30 threads per inch) in both the warp and weft, most preferably 7.8 threads/cm (20 threads per inch) in both directions.

5 12. A component according to Claim 9, 10 or 11 formed from a thermoset plastics material, preferably selected from one of GRP, vinyl ester, polyester, phenolic or epoxy resin.

13. A component according to any of Claims 9 to 12 in the form of a frame member.

10

14. A component according to any of Claims 9 to 12 in the form of a panel.

15. A method substantially as hereinbefore described.

15 16. A component substantially as hereinbefore described with reference to Figures 1A, 1B and 2.



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Application No: GB 0221677.8  
Claims searched: 7, 8 (in part)

Examiner: Monty Siddique  
Date of search: 15 September 2003

## Patents Act 1977 : Further Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
Y	7, 8	GB 2371075 A	(POLYMER ENGINEERING) pultruding plastics material to form door frame members 10 for attachment to edges of core 1, applying skins 2 to adhesive containing deformations 17 for forming a door etc.
Y	7, 8	WO 96/12611 A1	(OMNIGLAS) pultruded frame member with a peelable layer 41
Y	7, 8	JP 2178023 A	(HITACHI) pultrusion of plastics to form a moulding with a peelable layer to reveal a layer with formations
A		US 4492063	(SCHOCK & CO) extruded frame members with embedded elements

### Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category.	P Document published on or after the declared priority date but before the filing date of this invention.
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application.

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>v</sup>:

B5A; B5K

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

B29C; B29D; B32B; E06B

The following online and other databases have been used in the preparation of this search report :

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Application No: GB 0221677.8  
Claims searched: 1-4, 9 at least

Examiner: Monty Siddique  
Date of search: 20 March 2003

## Patents Act 1977 : Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1, 4, 9 at least	EP 1134314 A1	(HEXCEL) flexible assembly with fibrous layer embedded in resin but having portions exposed at the surface for adhering; see also drawing
X	1, 3, 9 at least	EP 0461901 A2	(AMERICAN COLLOID) flexible structural support member embedded in a major outer surface plasticised composition (clay composition), which is extruded
X	1, 9, 10 at least	US 5196092	(ALBANY INTERNATIONAL) portions of fibres of mesh embedded in plastics and extending beyond surface
X	1, 9 at least	JP 9174685 A	(BRIDGESTONE) flexible joint with embedded reinforcing material with exposed surface for adhesion
X	9 at least	JP 61062487 A	(NISSAN) flexible urethane foam embedded in seat cushions for cars
X	9 at least	GB 2245922 A	(COLEBRAND) mesh embedded in flexible tile adjacent surface 2 with part of mesh exposed
X	9 at least	GB 2237452 A	(ROGERS) flexible circuit 14 embedded in moulded plastics
X	9 at least	EP 0154121 A1	(CONTINENTAL GUMMI) strip 15 embedded in extruded elastomeric body
X	9 at least	DE 4217934 A1	(BURKHART) plastics strips embedded in plastics foam
X	9 at least	US 4476174	(TENEX CORPORATION) flexible plastics strip embedded in and laminated to a plastics web
X	9 at least	US 4354509	(SIEMENS) flexible plastics parts embedded in plastics

Categories:



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**Application No:** GB 0221677.8  
**Claims searched:** 1-4, 9 at least

**Examiner:** Monty Siddique  
**Date of search:** 20 March 2003

<b>X</b> Document indicating lack of novelty or inventive step	<b>A</b> Document indicating technological background and/or state of the art.
<b>Y</b> Document indicating lack of inventive step if combined with one or more other documents of same category.	<b>P</b> Document published on or after the declared priority date but before the filing date of this invention.
<b>&amp;</b> Member of the same patent family	<b>E</b> Patent document published on or after, but with priority date earlier than, the filing date of this application.

**Stage of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>v</sup>:

B5A

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

B29C

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